REMARKS/ARGUMENTS

In response to the Official Action mailed March 30, 2004, Applicants request reconsideration. In this Response, no claims are added or canceled so that claims 1-5, 7-19, and 21-66 remain pending. No claims are amended in this Response.

The Official Action objected to claims 2, 12, 14, 16, 26, 28, 33, 38, 43, 45, 47, 52, 57, 62, 64, and 66 as informal. The Official Action contends that these claims must be written in independent form. If the objection is to be maintained, Applicants request the Examiner to provide authoritative support as to why the present claim format of those claims is informal.

The Official Action rejected claims 1-5, 7-19, and 21-66 as non-statutory subject matter. The Official Action also rejected claims 1-5, 7-19, and 21-66 as unpatentable over Cormen et al. ("Introduction to Algorithms," hereinafter Cormen) in view of Bozkaya et al. ("Indexing Large Metric Spaces for Similarity Search Queries," hereinafter Bozkaya).

As explained below, data structures and methods for creating them are patentable. A data structure is not a mere abstract idea, and accordingly, a method for creating such a data structure exhibits utility. Furthermore, the combination of Cormen and Bozkaya fails to teach or suggest all of the claimed limitations. The methods taught by that combination are different from the present invention, and as a result, produce entirely different data structures that those created by the method of the present invention.

Data Structures And Methods For Creating Them Are Patentable

A claimed computer-related process is statutory if it is limited to a practical application within the technological arts. *See Diamond v. Diehr*, 450 U.S. 175, 209 USPQ 1 (1981). A claim is limited to a practical application when the method, as claimed, produces a concrete, tangible and useful result. *See AT&T Corp. v. Excel Communications, Inc.*, 172 F.3d 1352, 1357, 50 USPQ2d 1447, 1451 (Fed. Cir. 1999). In the present application, all claims are directed to a method of creating a binary tree, i.e. within the context of the application, a binary tree data structure. Given the pervasive use of binary tree data structures throughout the field of computer science, which is clearly a technological art, it is obvious that a method for creating such binary tree data structures produces a concrete, tangible, and useful result. Binary tree data structures allow data to be stored, arranged, sorted, searched, and transported in an efficient manner. This result is certainly concrete, tangible, and useful.

The Official Action contends that the claims recite only an abstract idea, merely the calculation of a median element. The claims clearly call for more. The claims are directed to a process for creating binary tree data structures, not merely finding a median of a list. This process is not abstract – the application concretely describes and claims how to construct organizations of data that can be manipulated. The Official Action contends that the process recited by the claims could be performed in the mind of a user or with a pencil and paper. The Official Action is wrong. simply put, it is physically impossible for a data structure to be created in the mind of a user or by placing ink on paper. . Thus the rejection under 35 U.S.C. 101 is erroneous and should be withdrawn.

The Cited Art Fails to Teach of Suggest Every Claim Limitation

Applicants initially note that Cormen is of no relevance to the present application, since it does not disclose any method for creating binary trees. Cormen merely describes the initialization steps performed by a Create call (see p. 388 of Cormen). However, the actual implementation of the create method, e.g. how the elements are inserted into the tree, is completely absent from Cormen. Accordingly, Cormen cannot be relied upon to teach or suggest any part of the invention.

The combination of Cormen and Bozkaya fails to teach or suggest every limitation of the claims. In the Amendment of March 18, 2004, Applicants argued that given a list of three elements A, B, and C, the tree creation method of Bozkaya may select C as the root node, whereas the present invention requires B to be selected as the root node. The Official Action responded by noting that the choice of the root node Bozkaya may be arbitrary, and thus could also select B as the root node. Such reasoning is directly contrary to the principle that every limitation must be taught or suggested. It is not enough that an element of the claims theoretically could exist without contradicting the teachings of a referece. Thus, the mere possibility that the method of Bozkaya *might* choose B as the median and thus *might* produce the same binary tree merely proves Applicants' point that there is no *teaching* or *suggestion* to use the median, as claimed (see Section 3.3 of Bozkaya). This fact is clearly evident from the description of the method, which notes that the vantage point (root node) may be any of the set elements (see Section 3.3 of Bozkaya).
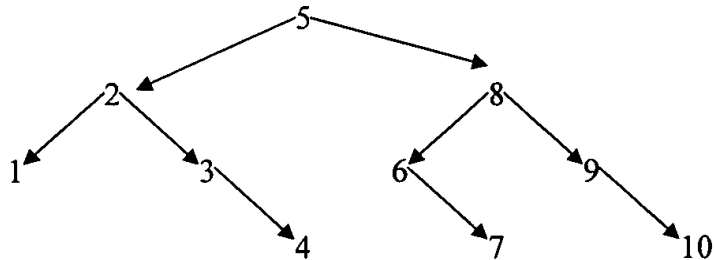
Furthermore, the Official Action asserts that Bozkaya teaches "subdividing a list into two lists of equal cardinality at the median." That assertion is cannot be correct. As clearly explained in Bozkaya, the list is divided into two lists of equal cardinality based on distance from the vantage point. The distance determining whether elements are placed in the left list

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or right list is the median distance of all set elements from the vantage point (see Section 3.3 of Bozkaya).

To demonstrate the differences between the method of the present invention and that disclosed in Bozkaya, consider the following set $S = (3, 9, 7, 1, 2, 6, 5, 8, 10, 4)$. According to the method claimed in the present application, the creation of the binary tree would proceed as follows:

1. The median M of the set is found, and the set is divided in to a left set S_L and a right set S_R based on the median. In this case, $M = 5$, $S_L = (3, 1, 2, 4)$, and $S_R = (9, 7, 6, 8, 10)$. The median M is set as the root node of the tree.

2. Next, the process is repeated for S_L and S_R. Thus, for S_L the median $M_1 = 2$, $S_{L1} = (1)$ and $S_{R1} = (3, 4)$. For S_R, the median $M_2 = 8$, $S_{L2} = (6, 7)$, and $S_{R2} = (9, 10)$. Accordingly, M_1 is set as the left child of the root M and M_2 is set as the right child of root M. The process is repeated for S_{L1}, S_{R1}, S_{L2}, and S_{R2}.

3. Since S_{L1} has only one element left, obviously median $M_3 = 1$. For S_{R1}, $M_4 = 3$, and $S_{R3} = (4)$. For S_{L2}, median $M_5 = 6$ and $S_{L3} = (7)$. For S_{R2}, median $M_6 = 9$ and $S_{R4} = (10)$. Accordingly, M_3 is set as the left child of M_1, M_4 is set as the right child of M_1, M_5 is set as the left child of M_2, and M_6 is set as the right child of M_2.

4. The three remaining sets S_{R3}, S_{L3}, and S_{R4} have only one remaining element. Thus, the right child of M_4 will be $M_7 = 4$. The right child of M_5 will be $M_8 = 7$. The right child of M_6 will be $M_9 = 10$.

The resulting tree looks like:

By contrast, consider the operation of the Bozkaya method on set S. Notably, in Bozkaya the creation of the binary tree is based on a distance metric from an arbitrary vantage point rather than the median of the set (see Section 3.3 of Bozkaya). However, to

illustrate the differences between the methods *even if* Bozkaya arbitrarily selects the median as the vantage point, assume the arbitrary vantage point is the median of the set, and thus S_v = 5. The method progresses as follows:

1. M is calculated to be the median of the distances of all set members from S_v. Thus, for set S the set of distances $D = d(S_i, S_v)$ for all elements of the set is $D =$ (2, 4, 2, 4, 3, 1, 3, 5, 1). Accordingly, the median M of $d(S_i, S_v)$ is 3. To clarify, every member of the set is either 1, 2, 3, 4, or 5 "places" away from the vantage point. Obviously, 3 is the median of all of those distances.

2. Next, the remainder of set S is divided into a left set S_L and a right set S_R based on distance from the vantage point. If a set member is less than or equal to M, it is placed in S_L. If a set member is greater than or equal to M, it is placed in S_R. For example, "3" is of distance 2 from S_v. Because 2 is less than the median of D, "3" is placed in the S_L group. After this division, the result is that $S_L = (3, 7, 6, 4)$ and $S_R = (9, 1, 2, 8, 10)$.

This analysis need not proceed any further. Because the two methods result in two different divisions of the initial set, it is obvious that they cannot produce the same tree. That is, because S_L in the method of the present invention is different from S_L in the method of Bozkaya, and because S_R in the method of the present invention is different from S_R in the method of Bozkaya, it is clear that the ordering of the tree will be vastly different. Thus, besides the apparent differences between the two methods, the Official Action's assertion that Bozkaya teaches or suggests the method of the present invention is illogical and untenable in view of the fact that the two methods produce different results.

Thus, the combination of Cormen and Bozkaya clearly fails to teach or suggest every limitation of any claim. Accordingly, *prima facie* obviousness has not been established, and the rejection should be withdrawn. If the present rejection will be maintained, the Applicants request that the above exemplary set S be used to illustrate how, when the teachings of Bozkaya are applied, the resulting binary tree data structure is equivalent to that created by the claims of the present application.

Respectfully submitted,

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